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Inventory Management Analysis of Essential Drugs for Public Health System in Bihar

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ABSTRACT

This study examines and defines the degree of essentiality for EDL drugs in terms of therapeutic/clinical as well as financial aspects in the Public Health System of Bihar by analysing them in terms of ABC, VED, and ABC-VED Matrix categories. Additionally, for the advocacy to improve the inventory management of the Public Health system in Bihar, resulting in improved budget utilization, reduced stockouts of important drugs, and minimized expiry of medicines. This scientific analysis provides evidence-based methodology for procurement planning and inventory optimization in resource-constrained public health systems, contributing to SDG Goal 3 (Good Health and Well-Being) for India under SDG Goal 2030.

Out of a total of 320 drugs, 29 drugs (9.06%), consuming 70% of total annual expenditure (TAE) were group 'A' items. 52 drugs (16.25%) consuming 20% TAE formed group 'B', and the remaining 239 drugs (74.69%) consuming only 10% of TAE were group 'C' items. 14 drugs (4.38%) were considered 'Vital'; 123 drugs (38.44%) were 'Essential,' and 183 items (57.19%) were 'Desirable'.

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Introduction

The procurement and cost of inventory management of essential drugs consume a significant part of the state government budget and impact the proper utilization of taxpayers' money. Scientific tools and techniques, such as ABC, VED Analysis, and ABC-VED matrix categorize the items based on the rate of consumption and the degree of essentiality of EDL drugs for the state/public health system and involve costs to identify the optimum inventory of the essential drugs and

subsequently better procurement planning for the next financial year.

Hence, the objective is to manage the optimum inventory level to minimize inventory costs and maintain the appropriate stocks of items based on their respective needs. Inventory management tools, such as ABC and VED analyses, are being increasingly utilized by healthcare organizations. These scientific tools and techniques were applied to essential drugs as per EDL 2018 for the Public Health System of Bihar.

Background / Study Rationale: The effectiveness of any Public Health Supply Chain Management depends on how it ensures the uninterrupted accessibility of essential drugs in public health hospitals/facilities, which is one of the key components of a well-functioning health system. Strengthening the Public

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health supply chain is, therefore, a vital component of health system strengthening, under the 'Medicines and Technologies' component of the WHO systems strengthening building blocks. There is a need for a study to determine how efficient and effective the SCM system is currently going on, to understand how to confirm the uninterrupted accessibility of essential drugs and consumables at healthcare facilities.

The estimated population in Bihar is approx. 104 million. Bihar, having a complex public health supply chain, caters to 38 districts through three Regional Drug Warehouses located at Patna, Muzaffarpur, and Purnia. The Bihar Medical Services Corporation Infrastructure Limited (BMSICL) manages procurement and distribution of essential medicines across tertiary, secondary, and primary care facilities. Given the scale of operations and limited public resources, scientific inventory management becomes critical for ensuring drug accessibility while optimizing budget utilization.

Objectives of the study

This study aims to understand the efficiency of the supply chain management of essential drugs in the public health system in Bihar. Additionally, to analyze the maturity of Procurement planning using scientific tools and techniques for Inventory management of essential drugs in Bihar, viz, ABC analysis, VED analysis, and the ABC-VED Matrix. Moreover, to understand whether these tools are being utilized using DVDMS /e-Aushadhi in Bihar.

Literature Review

Studies have shown that poor availability of medicines, especially in the public sector, is a key obstacle to access to health (Alexandra Cameron, 2011). The study "Availability of medicines in public sector health facilities of two North Indian States" (Haryana and Punjab), Prinja et al. *BMC Pharmacology and Toxicology* (2015) concluded that robust IT systems should be used for scientific warehousing, inventory management, and real-time data for decision-making. In another study, "Improving Availability and Accessibility of Medicines: A Tool for Increasing Healthcare Coverage", S Sharma - 2015 also concluded that efficient drug supply management ensures sustainable access and availability of essential medicines in the public sector. Another study, "Understanding public drug procurement in India: a comparative qualitative study of five Indian states" (Tamil Nadu, Kerala, Odisha, Punjab, and Maharashtra), Singh PV, Tatambhotla A, Kalvakuntla R, M. Chokshi, et al. *BMJ Open* (2013) asserts that

some critical success factors define the success of any procurement system. An inventory model that can solve supply chain problems in logistics operations in the Public Health System is an interesting issue to be discussed.

Methodology

This study was conducted on annual issue data as proxy uses of medicines and expenditures incurred on each item of the essential drugs and consumables procured for Bihar State Health Society (Health Department) by Bihar Medical Services Corporation Infrastructure Limited (BMSICL) and issued through three Regional Drugs Warehouse (Patna, Muzaffarpur, and Purnia) across all 38 districts (Hospitals / Healthcare Facilities) in Bihar during the year 2023-2024. The data were collected from the Supply Chain Management software called DVDMS (Drugs and Vaccine Distribution Management System) / E-Aushadhi used in Bihar. This DVDMS software has also been used in 22 other states in India for essential drug supply chain management. It has also been randomly cross-checked with suppliers' registers and bills.

Data Analysis

Firstly, the Total Annual Expenditure was calculated for 1 year by totalling the expenditure incurred for each item. Then, an ABC analysis of EDL medicines in the stock/inventory was performed, for which the yearly total cost of each drug was organised in the order of descending. The cumulative price of all drugs was computed. The % cumulative costs and the % cumulative of the number of items were computed. The list was further divided into 3 types: A, B, and C, based on the % of total cumulative cost, i.e., 70%, 20%, and 10, respectively.

Secondly, VED analysis (based on degree of therapeutic essentiality) of all itemised drugs was executed through categorising the drugs into Vital (V), Essential (E), and Desirable (D) types. Drugs critically required for the lives of patients were incorporated in the V category. Drugs with lesser critical requirements and those whose absences could be tolerated for a brief period in public healthcare facilities were incorporated in the E category. The drugs with the lowest degree of criticality, the absence of which would not be detrimental to the health and well-being of patients for some time, were included in Category D. The degree of essentiality/criticality was applied at the time of drug classification to categories V, E, and D. Finally, the matrix was formulated with the combination of ABC & VED analyses to know the level

of evolved public health SCM System of which can be used for prioritization of essential drug procurement planning, budgeting by the State Health Society, Bihar (Health Department), and Procurement by Bihar Medical Services Corporation Infrastructure Limited (BMSICL) as well as inventory management by the hospitals and public health facilities in the state.

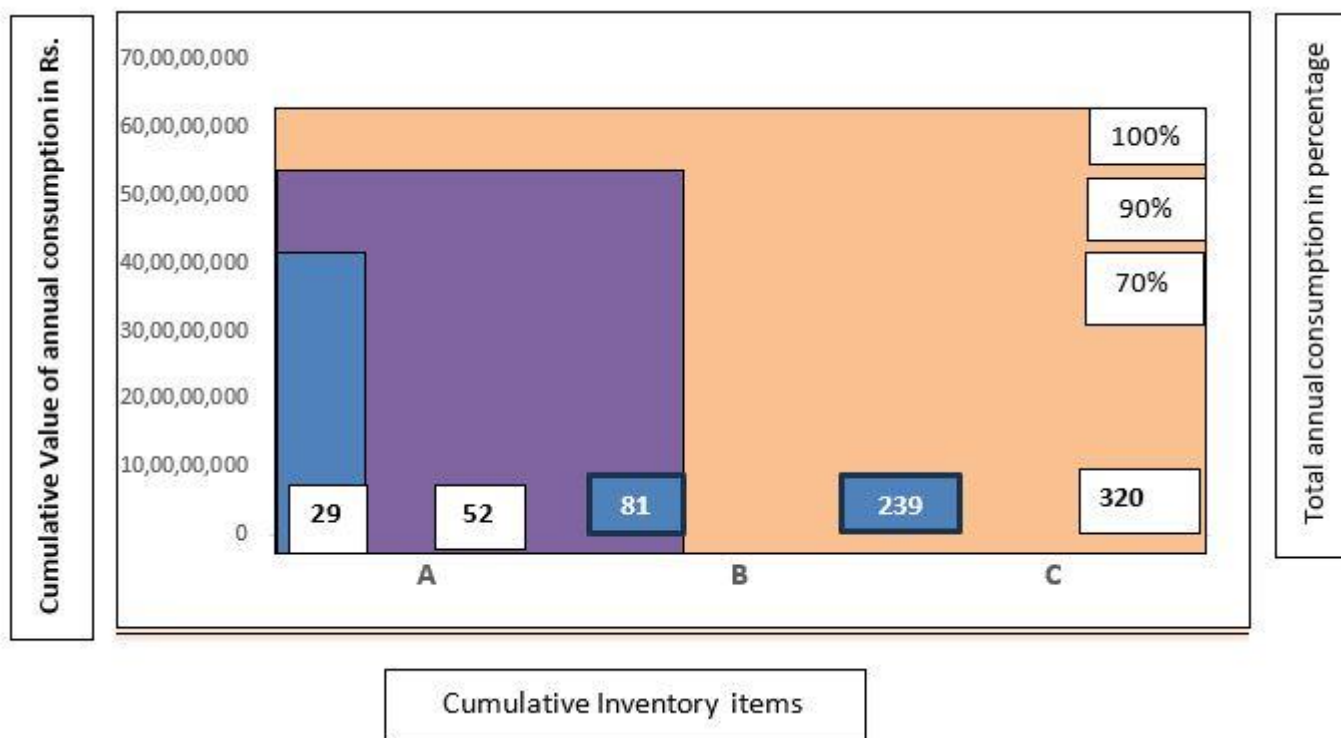
Result

The exclusive EDL drugs issued in FY 2023-24 by BMSICL across the 38 districts in Bihar were 320 EDL drugs (non-EDL drugs excluded). The total annual drug

expenditure of the State Health Society, Bihar (Health Department) on items issued in FY 2023-24 was Rs 62,54,53,825. These expenses do not comprise the inventory carrying cost or inventory storage cost. As shown in Table 1, 29 of these drugs, 29 items (9.06%), consumed 70% (Rs 43,78,17,678) of total annual drug spending, containing group 'A' items. 52 drugs (16.25%) consumed 20% (Rs 12,50,90,765) of the 1-year drug expenses, creating group 'B' items. The remaining 239 items (74.69%) spent only 10% (Rs 6,25,45,383) of the total expenditure budget, categorised as Group 'C' items.

Table 1: ABC analysis.

Drug Analysis	Category			Total
	A	B	C	
Total annual expenses in %	70%	20%	10%	100%
Annual expenses value in Rs	43,78,17,678	12,50,90,765	6,25,45,383	62,54,53,825
No. of Items	29	52	239	320
% of items	9.06%	16.25%	74.69%	100%



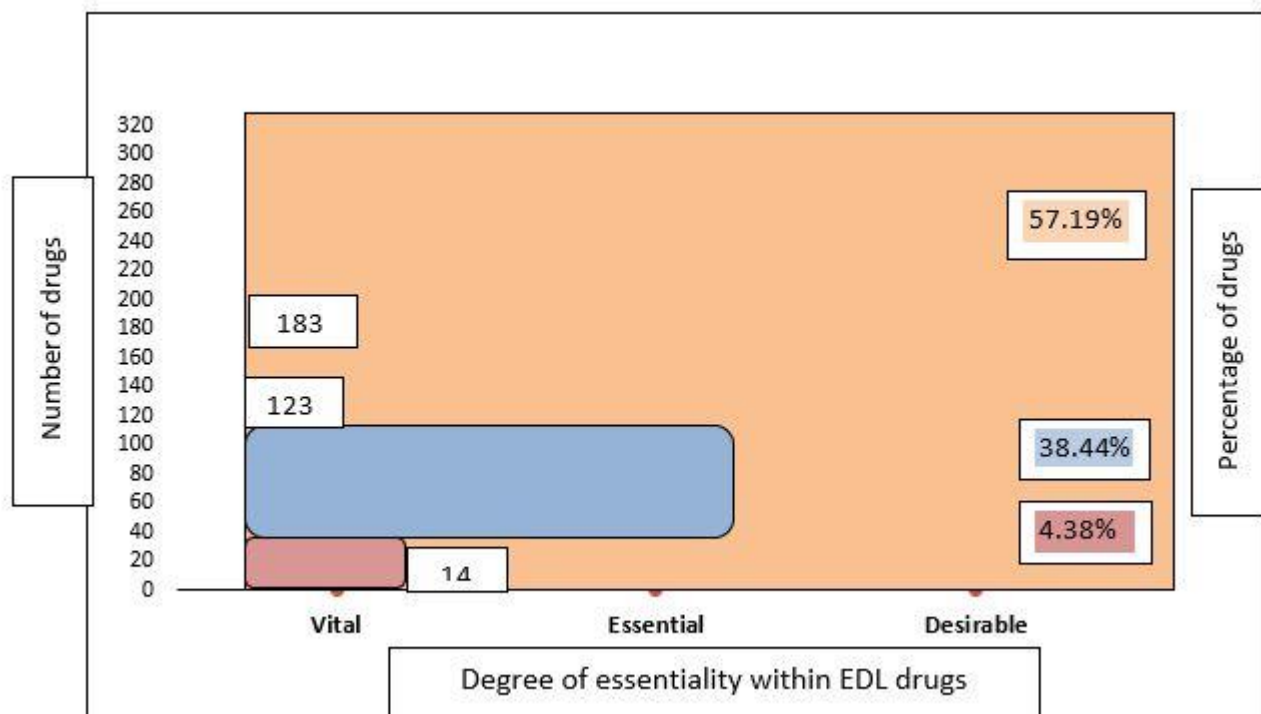
Graph 1: Schematic representation of ABC Analysis

For ABC, analysis (Table 1), the total annual value of expenses which is considered and has nothing to do with the unit cost of the drugs. VED sorting of the inventory shown in Table 2 discovered that out of 320 drugs, 14

drugs (4.38%) were considered 'Vital' by the team, 123 items (38.44%) were 'Essential', and the rest 183 items (57.19%) were considered 'Desirable'.

Table 2: Distribution of drugs into VED classification.

Drugs Category	No. of drugs	% of drugs
Vital	14	4.38%
Essential	123	38.44%
Desirable	183	57.19%
Total	320	100%



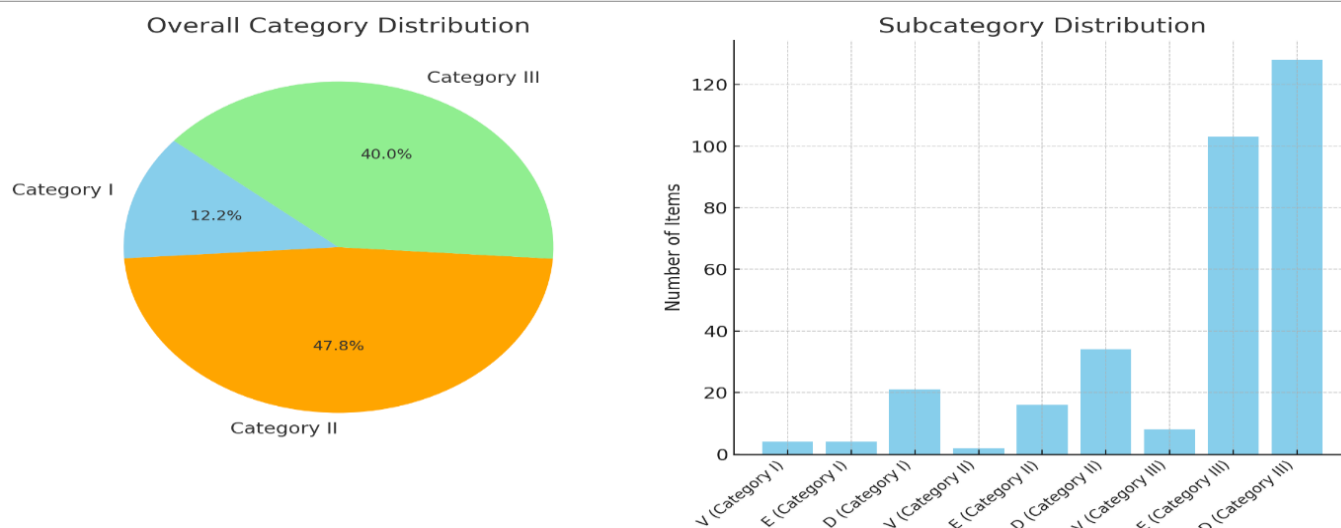
Graph 2: Schematic representation of VED Analysis.

The matrix of ABC & VED for the inventory shown in Table 3 discloses that 39 drugs (12.19%) out of 320 drugs constituted group I drugs. Four drugs of group I, high cost as well as vital, four were high price and essential, and 21 were high price and desirable.

Category II, 153 drugs (47.81%) was comprised of intermediate and low cost and essential items numbered 119, relatively lower cost and desirable drugs numbered 34, while 128 drugs (40.0%) were lower cost and essential.

Table 3: Matrix of ABC & VED.

Category of Drugs	V	E	D	Matrix classification
A	AV	AE	AD	Category I- 39 items (12.19%)
Category I	4	4	21	(AV+AE+AD+ BV+CV)
B	BV	BE	BD	Category II- 153 items (47.81%)
Category II	2	16	34	(BE+CE+BD)
C	CV	CE	CD	Category III- 128 items (40.0%)
Category III	8	103	128	CD



Graph 3: Graphical representation of ABC & VED Matrix.

Discussion

This study displays that out of a total of 320 items, 29 belong to category A, which consumes approximately 70% of the annual expenditure on essential drugs by the state health Department (SHSB / BMSICL). Drugs in this category must be ordered frequently to prevent the locking of capital in buffer stocks. During inventory management, ABC analysis should not be considered alone as it may effectively control drugs from category

A but lead to a compromise on the availability of the Vital B and C category drugs; Hence, VED analysis is combined with ABC analysis for more accurate and optimal inventory management. The optimum quantity of category I drugs can be checked in the budget, as well as drug availability, as these are expensive and vital items. Similar Indian studies also prove that Category II and III items can be ordered in smaller amounts often, thus saving on ordering costs and holding significant cash flow.

Table 4: Comparison of study outcomes with previous relevant studies in Public Healthcare Organizations in India (Value in %).

Category	GMC Nagpur	AFMC study	PGI Chandigarh	Pune Hospital	This study (Bihar)
A	10.76	14.46	13.78	1.21	9.06
B	20.63	22.46	21.85	2.08	16.25
C	68.61	63.08	64.37	97	74.69
V	23.76	7.39	12.11	11.02	4.38
E	38.12	49.23	59.38	49.13	38.44
D	38.12	43.38	28.51	39.84	57.19
I	29.15	20.92	22.09	11.80	12.19
II	41.26	48.92	54.6	48.26	47.81
III	29.59	30.16	23.28	38.97	40.00

Inventory management tools and techniques are very relevant at the state level (SHSB/BMSICL) for Procurement Planning and budgeting across the state in public health systems other than individual healthcare provider organizations. During the desk research, no similar studies were found for any state in India among the relevant studies conducted in the past. Therefore, this study has been compared with similar studies conducted in the past for Government Medical Colleges & Hospitals / Public healthcare providers.

Table 4: The comparisons of the results of this study with those of previous similar kind of studies on the proportion of drugs in various categories. 9.06% of total drugs fit into category A in my study, whereas the values were 10.76% GMC, Nagpur study, 14.46% in the AFMC study, 13.78% in the PGI Chandigarh study, and 1.21 % in Pune Hospital Study. Likewise, category B (16.25%) and category C (74.69%) drugs were comparable with values in studies in GMC-Nagpur, AFMC-Pune, and PGI-Chandigarh as 20.63%, 22.46%

21.85% 2.08 (Category B), and 68.61%, 63.08%, 64.37%, and 97% (Category C), respectively. There was a high difference in the % of vital, essential, and desirable drug items. This probably will be because different hospitals & healthcare organizations have different services to be provided, based on the specialty services available, and differ in their strategies of categorising drugs into A, B, C, Vital, Essential, and Desirable groups. Annual procurement planning and inventory control are essential for quality enhancement in patient care and strive for the optimum usage of funds. Continuous quality improvement results in the value being returned to the patients. Of all available inventory control systems, the ABC (always better control) and VED (Vital, Essential, and Desirable) matrices are the most preferred for healthcare service providers.

Conclusion

The annual Procurement Plan and the utilization of Inventory Management tools should not be a one-time assessment; rather, regular monitoring should be performed at the State Level (SHSB/BMSICL) as well as at every level of the healthcare facilities where the inventory of essential drugs is maintained. This needs the application of management tools of inventory management for effective and competent administration of state/regional/district drug stores, effective priority setting, decision-making in centralized purchases at the state level (SHSB/BMSICL), supply of precise drug items, and close supervision of drugs fit into important categories. ABC and VED analyses identify drugs requiring stringent control for the optimal use of public funds and elimination of out-of-stock situations in the public healthcare system in the state, resulting in reduced out-of-pocket expenses (OOPE) from poor persons within the population in the state (SDG Goals 2030).

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Conflict of Interest

None.

Author Contributions

All the authors contributed to the study.

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